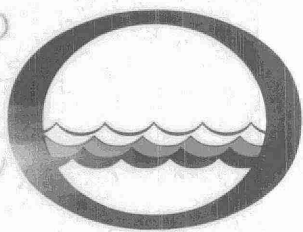


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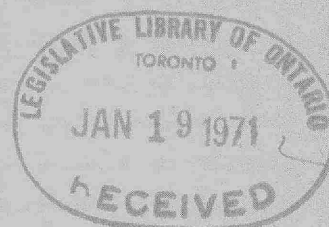
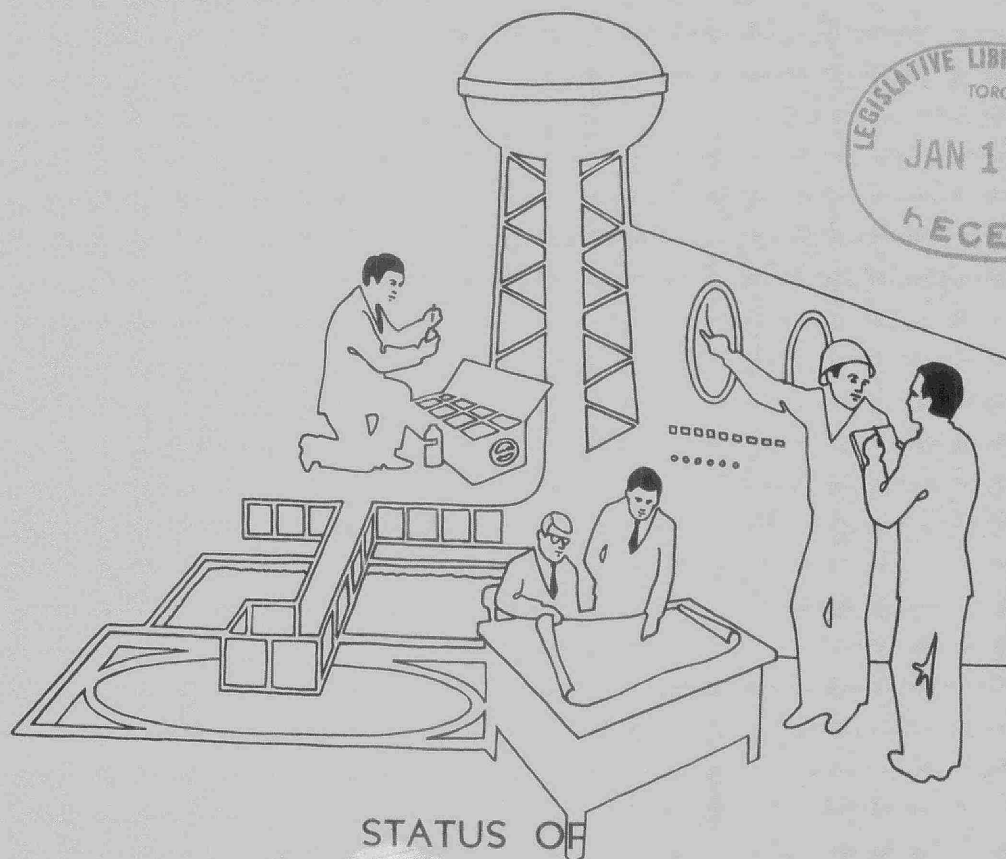


Water management in Ontario

Ontario
Water Resources
Commission

District
Engineers
Branch

District Engineer
Br



STATUS OF
MUNICIPAL WATER POLLUTION CONTROL
in the
TOWN OF PENETANGUISHENE
COUNTY OF SIMCOE

September - October, 1970

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1970

R E P O R T

TOWN OF PENETANGUISHENE
MUNICIPAL WATER POLLUTION CONTROL

COUNTY OF SIMCOE

1970

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MAP ENCLOSED

REPORT

Ontario Water Resources Commission

September 23 and
October 21, 1970

Municipality.....Town of Penetanguishene.....Date of Inspection.....
Re:.....Municipal Water Pollution Control.....
Field Inspection by J.D. Snider, Civil Technologist Report by J. D. Snider

I INTRODUCTION

This report is the result of several field investigations during 1970. A discussion is made of the hydraulic and organic performance of the municipal water pollution control plant, and an evaluation of the municipal water works system. A 1970 follow-up study of the 1967 OWRC water pollution survey is reviewed, along with the conclusions of past surveys. The Town's development and future plans in pollution abatement are also discussed.

II GENERAL

The Town of Penetanguishene is located at the north end of Highway 27 on an inlet of Georgian Bay which is known as Penetanguishene Harbour.

The Town's population of approximately 5,000, although increasing considerably during the summer months, has not changed significantly in the past 10 years.

Drainage is provided mainly by the Penetanguishene Harbour waterway and a small watercourse draining to it,

known as Copeland Creek. A small area at the south end of the Town drains in an easterly and southerly direction.

A combined system of sanitary and storm sewers serving approximately 60 percent of the municipality is in use. Originally these sewers discharged into the harbour, but with the construction of the water pollution control plant the main outfalls have been intercepted and directed to this facility.

Septic tank systems and a few privies serve as sewage disposal facilities for the remainder of the Town.

III MUNICIPAL WATER WORKS

A. Description of Works

Water flows from two artesian wells into a 250,000 gallon underground reservoir from where it is pumped untreated into the distribution system. Another 250,000 gallon ground level reservoir located in the north end of town rides on the distribution system. A booster pumping station is provided to maintain sufficient pressure in the higher areas of the town. A physical description of the works is provided in Appendix A.

Based on October, 1968 flow tests, Wells 1 and 2 were observed to flow at 370 and 760 IGPM, or

532,800 and 1,094,400 IGPd respectively. This would result in a combined capacity of the two wells slightly exceeding 1.6 IMGd. Well #1 is equipped with a Layne turbine pump; however, under normal circumstances, the free-flowing yield of the well is sufficient.

The Mental Health Center at Penetanguishene uses this water supply but maintains its own chlorination system since problems had been encountered with adverse bacteriological results in the hospital's distribution system.

Since the town is almost 100 percent serviced by municipal water there are no major private or industrial water supplies.

B. Water Consumption

Appendix C, Tables 1 and 2 present a summary of the total water consumption during the years of 1968 and 1969. A 1969 total of 205,020,000 IG or an average of 561,698 IGPd, represents an increase over the 1968 consumption by roughly 20 percent. This same increase is also shown in the WPCP average flows. Based on a 1969 assessed population of 5,109, a per capita consumption of 110 GPCD is indicated. It should be noted that only the water pumped to the town is metered, and there is a constant overflow from the artesian wells.

The following is a breakdown of homes serviced by municipal water and sewers, and also the major consumers of water within the Town for 1968, 1969 and an estimation for 1970.

	<u>1968</u>	<u>1969</u>	<u>1970 (est.)</u>
Number of Family Units on Water	1345	1455	1476
Number of Family Units on Sewers	825	941	965

Major Consumers of Water (x 1000 gal.)

	<u>1968</u>	<u>1969</u>	<u>1970 (est.)</u>
<u>On Sewers:</u>			
Grew Boats Limited	826	654	2388
Hotel Brule	2066	2816	2372
Penetang Bottling Co.	5597	4868	4749
Dominion Stores	2980	3250	3165
Coomodore Hotel	2021	2064	2606
Robbies IGA	2992	3464	3772
Penetang General Hospital	3701	6308	7399
Georgian Manor	<u>2106</u>	<u>2227</u>	<u>2121</u>
TOTAL	22289	25651	28572

Not on Sewers:

Mental Health Center	<u>39609</u>	<u>38988</u>	<u>38683</u>
TOTAL	61898	65539	67255

The above results in a pure residential demand for 1969 of 139,481,000 IG or 75 IGCD. This represents 68 percent of the total consumption.

The supply of water to consumers on municipal sewers was approximately 317,000 IGPD (See Appendix H) as compared to a sewage flow of 327,000 IGPD. A discussion of this comparison is made under the WPCP section.

It is evident from comparing the 1969 maximum day of 850,000 I gal. and the above average value, to the combined well capacity of over 1.0 IMGD (1968 flow tests), that the supply of water is not a limiting factor in the growth of Penetanguishene.

C. OWRC Inspections

Our latest letter on the water system, dated October 1, 1969, recommended the establishing of an adequate bacteriological sampling program. This program consists of sampling the wells and the point where the water enters the distribution system at least once per week, and a minimum of 15 samples per month from the distribution system. A letter dated October 6, 1969 was received from the town assuring that this sampling program would be initiated.

D. Water Quality

The Simcoe County District Health Unit collected 54 bacteriological samples from the distribution system during 1969, with one adverse result. To date in 1970, 49 samples have resulted in no adverse results. Chemically, the water is hard, and at times reveals a slightly high iron content.

IV MUNICIPAL WATER POLLUTION CONTROL PLANT

A. Description of Works

Treatment is provided by a 0.4 US MGD "Dravo Aeropack" activated sludge plant using the contact stabilization modification of the process. The effluent is disinfected with chlorine before being discharged to Penetanguishene Harbour.

The plant was designed to accommodate a population of 4,000, at a flow of 0.4 US MGD with an organic loading of 680 lbs. BOD per day.

A detailed physical description is given in Appendix B.

B. Organic Loading

A list of the results of chemical analyses of 37 samples submitted to the OWRC laboratory from January 1968 to August 1970 is appended in Appendix D, Table 1. These results represent an average BOD loading of 93 ppm or 310 pounds of BOD per day (assuming an average

daily flow of 400,000 US GPD), as compared to a design organic loading of 680 pounds of BOD per day. The BOD concentration equals or exceeds 90 ppm, 50 percent of the time. The average suspended solids concentration in the raw sewage was 128 ppm. This combination of weaker than normal sewage and high flows is representative of the ground and/or storm water that has access to the system.

It must be pointed out that the majority of the above samples were grab samples obtained between 8 and 9 AM. Grab samples are not representative of the true influent characteristics or plant performance. It is for this reason that all monthly routine samples should be of a composite nature encompassing approximately 8 hours of a day's flow.

Some composite sampling was done on February 25, 26, 27, 1969, and September 22, 1970. The former set of samples, listed in Appendix E showed an average raw sewage strength of 82 ppm. The BOD concentrations ranged from 90 to 130 ppm for the major part of the day and then dropped to around 40 ppm for the balance of the time. The average suspended solids concentration was 111 ppm.

The September study (Appendix F) resulted in similar levels from 65 to 110 ppm BOD between 10 AM and 8 PM, with an average of 80 ppm, and 100 ppm suspended solids. It appears that the true loading is roughly 260 pounds BOD per day, again assuming an average daily flow of 400,000 US gpm. The routine grab samples submitted over the past few years consistently show larger values due to the higher organic concentrations during the morning hours.

Considering the more reliable figure of 260 pounds BOD per day, the plant evidently has a surplus organic capacity of over 400 pounds BOD per day, while being hydraulically overloaded. To overcome this situation the municipality should continue to undertake as soon as possible the elimination of storm flow sources to the sewage treatment plant by providing separated sewer systems in the areas presently served by combined systems. The projected works program proposed by the municipality as explained later in this report, should, upon completion, adequately correct the situation.

C. Hydraulic Loading

Appendix G, Tables 1, 2 and 3 list plant flows for 1968, 1969 and part of 1970. A summary of these flows is presented as follows:

	1968 (11 months)	1969 _____	1970 (6 months)
TOTAL	116,325,800	143,045,808	84,702,215
Maximum Day	698,400	661,000	548,600
Minimum Day		180,500	206,100
Average Day	317,830	391,906	399,539
Design Flow	400,000	400,000	400,000
% Average Day of Design Flow	80%	98%	100%

Maximum day flows to the plant in 1969 ranged from 349,920 US gallons in August to 661,000 US gallons in January, whereas for the corresponding period the average day flows ranged from 239,478 US gallons in August to 489,677 US gallons in April. A comparison of average daily flows for the same 11 month periods shows almost a 20 percent increase in 1969 over 1968.

These flows take into account only treated sewage and do not include raw sewage which had to be bypassed. The flow charts show that February, March and April are months of high flow, a period during which bypassing occurs almost daily to prevent sludge wash-out at the plant. The operator reports that all flows exceeding 330,000 to 375,000 Imp. GPD are bypassed. Appendix G, Table 3 listing 1970 flows for the first eight months, gives the total hours per month that raw sewage was bypassed, and the percentage of

the month that bypassing occurred. This ranged from 69.75 hours or 9.7 percent of the month of June, which had the lowest flow, to 639.75 hours or 88.9 percent of the month of April. The plant was bypassing almost 40 percent of the time during the first eight months of 1970.

It is difficult to estimate the amount of sewage bypassed, since the outlet runs directly from the wet well to a submerged outfall.

Considering the total water consumption of 115.8 MIG or 0.317 MIGD from sewerer premises in 1969 (as calculated in Appendix H) and the total volume of sewage treated at the plant, 119.2 MIG or 0.327 MIGD, it appears that the plant is at or over hydraulic capacity from the water consumption alone, and that nearly all storm flows and runoff getting to the plant are bypassed. Appendix I, Table 3 presents hours of bypassing on a daily basis for the months of February and April 1970, along with amounts of precipitation, which were below normal, and the prevailing temperatures for each day. These two months are used for example purposes only, since April has the highest bypassing rate and February the lowest total precipitation of the first 5 months of 1970.

There were only 1.53 inches of precipitation during the month of February 1970; however, for the same month the water consumption from sewerred premises was approximately 350,000 Imp. GPD (60% of average daily flow) while the volume of treated sewage was 341,000 Imp. GPD. A similar comparison for the month of April presents much the same picture. Due to the absence of any significant precipitation during the same month, and the prevailing temperatures (measured at Collingwood meteorological station) being above freezing during the bypassing periods, it appears that runoff was the major contributor to the excessive flow, especially evident in April.

In an attempt to arrive at some estimate of the amount of sewage bypassed, calculations were made as to the volume of runoff reaching the sewage treatment plant during 1969. Information obtained from the municipality reported the area of Penetanguishene with sewers reaching the plant as being 625 acres. The total precipitation in the Penetanguishene area during 1969 as reported by the Department of Transport Meteorological Branch, was 38.51 inches. Using a runoff coefficient of 0.4, which may be fairly conservative in

this case, this results in a total runoff volume of over 200 MIG reaching the sewage treatment plant during the year. (See Appendix I, Table 4 for calculations) It can be inferred from this, and the previously mentioned water and sewage flows, that a major part of this combined storm and sanitary sewage is being bypassed without treatment to Penetanguishene Bay.

As stated previously, continued efforts must be made with all speed to separate the combined sewers, and eliminate the flow of storm water to the plant.

D. Plant Efficiency

Appendix D, Table 1 listing analyses results of samples obtained over the past two years, shows the average BOD and SS concentrations in the final effluent to be 7 and 10 ppm respectively, representing plant removal efficiencies of 92 percent. Again it has to be emphasized that the samples submitted have been mostly grab samples taken in the early morning, therefore, any plant assessment based on these sample results do not necessarily represent the true quality of the effluent.

The plant studies performed in February 1969 and September 1970 revealed slightly lower efficiencies. BOD and SS reductions of 87 and 80 percent were evident

during the February program, while 86 and 91 percent removals were found in the September study. It appears that a more reliable plant efficiency would be roughly 85 percent.

Although the plant is capable of effective treatment, the benefits in terms of water pollution control are not being realized due to the excessive bypassing of untreated sewage. The harbour has little in the way of flushing action and thus all the wastes discharged have a very serious effect upon the quality of the water in the bay and the bathing beaches surrounding it.

E. W.P.C.P. Nutrient Loading to Penetanguishene Harbour

Throughout the past few years, the OWRC has received complaints about algae problems in the Penetanguishene-Midland area of Georgian Bay. All natural waters support a variety of species of free-floating microscopic algae usually referred to as 'planktonic algae'. These microscopic plant cells normally are sparse enough so that many people are not even aware of algae being in the water. However, algae, like any other group of living organisms, grows in proportion to the food supply, and waste materials added to the water (e.g. sewage effluent) often fertilize algae and promote abundant

growths. For this reason, waters fertilized with wastes frequently experience algae 'blooms' at which times the water takes on a green colour as a result of the dense algae population. Due to the public concern about algae problems in this area of Georgian Bay, a study was begun in 1969 by the Biology Branch of the OWRC. The resulting status report on the water quality in the area will be released soon.

The September 1970 plant study revealed average Total Nitrogen and Total Phosphorus concentrations of 16.6 and 7.0 ppm, respectively in the final effluent, as summarized in Appendix F, Table 2. Applying an average daily flow of 330,000 Imp. GPD to these nutrient concentrations, results in the plant contributing in the neighborhood of 4 tons per year of phosphorus, and 10 tons per year of nitrogen. Although these figures are quite rough in nature, there is the indication of a very high loading of nutrients to the Penetanguishene Harbour. As previously mentioned, there is a very low flushing rate in the area, resulting in an accumulation of these nutrients. It should also be realized that this estimate does not include any bypassed sewage, which contains a higher level of nitrogen, and has been estimated in this report at an additional 200 million gallons per year.

V WATER POLLUTION SURVEYS

A. Introduction

Water pollution surveys of the Town of Penetanguishene were performed and reported on, in 1964 and 1967. At that time, samples were collected from the Penetanguishene Harbour, Copeland Creek, and all of the known discharges to these waterways. A follow-up investigation of the 1967 report was made in September and October, 1970. The appendices contain the results of the samples from both surveys, as well as an interpretation of the laboratory analyses.

B. Past Survey Conclusions and Action Taken

The original 1964 OWRC survey revealed that a large volume of polluted wastes was discharging from sewer and ditch outlets into Penetanguishene Harbour, along with leachate from the municipal landfill site reaching Copeland Creek. Samples collected along the harbour shore showed bacterial contamination in excess of the OWRC permissible limits.

The municipal water pollution control plant was constructed in 1966.

The 1967 OWRC survey again found the main problem to be the limitation of the sanitary sewer

system, necessitating the continued use of inadequate private sewage disposal systems, and resulting in the discharge of inadequately treated sewage to the storm drainage system. Varying degrees of pollution were noted in some storm drainage outlets. Excessive coliform counts were evident in Copeland Creek opposite the landfill site.

The following recommendations were made as a result of the 1967 survey:

1. A program of sanitary sewer extension should be initiated at the earliest possible date.
2. Measures should be taken to prevent the discharge of leachate to Copeland Creek from the old sanitary landfill site.

A sewer extension program has been initiated, as will be explained in Section VI.

The sanitary landfill site has been relocated in Tiny Township, Lot III, Concession 2, thus eliminating the Copeland Creek problem.

C. Water Pollution Survey Follow-Up: 1970

A follow-up sampling program of the 1967 survey was made on September 23 and October 21, 1970. The results of samples obtained at these times from storm sewer outfalls and Copeland Creek are listed in

Table 1 of Appendix J, along with the June 27, 28, 1967 results for the corresponding points.

This comparison of laboratory results indicate that inadequately treated sanitary sewage is still being discharged to the storm sewerage system which outfalls directly to Penetanguishene Bay. The two sewers with the highest level of pollutants were sampling points PH-6-W and PH-7-W, located at the foot of Scott Street, and just south of the WPCP, respectively. These two storm sewers contain bacterial concentrations of 500,000 to 700,000, and BOD levels of 11 to 14. The other outfalls show impairment of a slightly lesser degree. Where ingestion is probable, recreational waters can be considered impaired when the coliform, fecal coliform, and/or enterococcus geometric mean density exceeds 1000, 100 and/or 20 per 100 ml, respectively.

Sampling point W-1, a storm sewer discharging to a swampy area near the Ontario Hydro office, contained a high bacterial concentration and evidence of ethylene glycol. It appears that something of the nature of anti-freeze is gaining access to the storm sewer. Due to the critical location of this storm outfall with regards to the receiving stream eventually flowing into one part of the reservoir system for Midland, municipal

staff should locate and eliminate any sources of flow other than storm water. Municipal staff should also maintain a close watch on the quality of this storm sewer effluent by regular sampling.

VI FUTURE PLANS OF MUNICIPALITY

A. Projected Works Program : 1970 to 1974

Table 1, Appendix K, illustrates the municipality's projected works program for the years 1970 to 1974. The location of the sewer phases are indicated on the appended map.

This program involves the installation of sanitary sewers to areas now on combined sewers, thus separating the sanitary and storm flow and eliminating the discharge of untreated sewage from storm sewers. The municipality is planning on the separation of sewers providing additional capacity at the water pollution control plant, until the program date of 1973, at which time the plant is to be enlarged.

As explained in previous sections, the 1969 average daily flows for sewerage water consumption and the water pollution control plant, were almost the same. Therefore, separation of storm sewers will probably not do much to forestall plant enlargement, since the plant is already nearing its hydraulic capacity due

to water consumption alone. It is for this reason that consideration should be given to the possibility of initiating the sewage treatment plant enlargement before the existing program's date. Following council's review of this report, we would like to attend a meeting with council, or an appropriate committee of council, to discuss this program and any other matters related to the report.

VII SUBDIVISION DEVELOPMENT

During the past several years, there has been no subdivision development within the Town of Penetanguishene. The population of the town has not changed significantly for many years.

VIII SUMMARY AND CONCLUSIONS

The supply of water is not a limiting factor in the development of Penetanguishene, since the combined well capacity is in the neighbourhood of 1.5 MIGD, while the 1969 average daily flow was 0.56 MIGD or 110 IGCD. The pure residential demand of 75 IGCD represents 68 percent of the total water consumption.

The organic loading of the water pollution control plant is roughly 260 pounds BOD per day, resulting in a surplus organic capacity of over 400 pounds BOD per day while nearing its hydraulic capacity. The 1969 average daily flows from

sewered premises, and of the sewage treated at the WPCP were 0.317 and 0.327 MIGD respectively, resulting in the major portion of all storm flows and runoff reaching the plant, estimated at roughly 200 MIG, being bypassed to the bay without treatment. During the first eight months of 1970, bypassing occurred almost 40 percent of the time.

Plant studies showed BOD and SS removal efficiencies of 87 and 80 percent respectively. Although the plant is capable of effective treatment, the excessive bypassing of combined storm and sanitary flows nullify somewhat the water pollution control benefits. An estimate of the nutrient loading to the bay from the plant's final effluent results is 4 tons per year of phosphorus, and 10 tons per year of nitrogen, not including bypassed sewage.

The water pollution survey follow-up supports the findings of the 1967 report, in that the main problem is the limitation of the existing sanitary sewerage system allowing untreated sewage to reach Penetanguishene Bay, of which the municipality is aware.

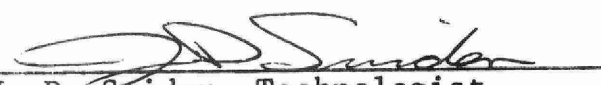
The town's projected works program for 1970 to 1974, should upon completion, take care of the present sewerage limitations, although consideration should be given to initiating the sewage treatment plant extension at an earlier date.

Following council's review of this report, we would like to attend a meeting with council, or an appropriate committee of council, to discuss the above mentioned program, and any other matters concerned with this report.

IX RECOMMENDATIONS

1. The Town of Penetanguishene should proceed as quickly as possible with the projected works program, as outlined in this report, so as to direct all sanitary wastes from the town to the water pollution control plant by separating the presently combined sewers, thus eliminating the flow of storm water to the plant.
2. Due to the existing sewage treatment plant nearing its hydraulic capacity from sewerage water consumption alone, the Town of Penetanguishene should consider the immediate initiation of plant expansion, instead of the projected date of 1973.
3. In order to obtain a true representation of the influent characteristics or plant performance, all monthly routine samples should be of a composite nature encompassing approximately eight hours of a day's flow.

Prepared by:


J. D. Snider, Technologist
District Engineers Branch
Division of Sanitary Engineering

/cs

APPENDIX ATOWN OF PENETANGUISHENEWATER WORKSPHYSICAL DESCRIPTIONSOURCE

2 - Artesian wells
Primary well - 197 feet deep, 16-inch casing
Secondary well - 190 feet deep

PUMPWELL

250,000 gallon reinforced concrete ground reservoir

SERVICE PUMPS

2 - Allis-Chalmers electric pumps, each rated at
450 gpm @ 220 ft. head and each driven by a 40 HP
electric motor

STANDBY PUMP

Allis-Chalmers centrifugal pump rated at 1250 gpm @
280 ft. head, driven by a diesel engine of about 120 HP

BOOSTER PUMP

2 - Allis-Chalmers centrifugal pumps rated at 100 gpm
each and driven by a 5 HP electric motor

STORAGE

250,000 gallon ground reservoir

STANDBY GENERATOR

a diesel powered standby generator is provided at the
main pumping station

APPENDIX BTOWN OF PENETANGUISHENEW.P.C.P. PHYSICAL DESCRIPTION
(October 1966)TYPE

Contact stabilization modification of the activated sludge process (by Dravo Pack)

Dravo Pack - Basically two concentric steel tanks of 62 and 32 feet diameter

DESIGN

Design Population	-	4,000
Design Flow	-	330,000 gpd
5-Day BOD	-	680 lb./day
Removals	-	approx. 90 percent

NB: The above capacity can be trebled by adding two more Dravo Pack Units

WET WELL

Capacity	-	1,000 gal.
----------	---	------------

Pumping Equipment

2 - Patterson Horizontal Centrifugal variable speed pumps each rated at 700 US gpm at a head of 31 ft. (880 rpm), and each driven by a 15 HP electric motor

NB: Impeller changes can increase the capacity of each pump to 2,100 US gpm @ 33 ft. head.

COMBINED GRIT SETTLING TANK & FLOW SPLITTER

Dimensions	-	approx. 10 ft. diameter by 3.3 SWD
Capacity	-	approx. 2,400 gal.

This unit is designed to split the flow between three identical Dravo Pack Units. Rate of grit fall is greater than water rise.

Pumping Equipment

1 - Wemco centrifugal pump rated at 100 US gpm at a head range of 20 - 43 ft. and rpm's from 700 - 1400 and driven by a 7.5 HP electric motor

The pump is for grit and sludge handling and can be adapted to 10 separate distribution functions. Air bubbles at the base of the intake header ensure flotation of organic matter returned from the Hydro-Cyclone separator. A grit rake distributes grit to a central hopper.

NB: Hydro-Cyclone separator - is an Archimedes screw washed with a water jet

Mixing Tank (for absorption and adsorption of BOD)

Capacity - 41,500 gal.

Activated sludge and influent has from 30 - 60 minutes continuous aeration

Settling Tank

Capacity - 52,500 gal.

Retention - approx. 4 hours at 330,000 gal.

Pumping Equipment

Air-lift capacity - 230 gpm

CHLORINE CONTACT CHAMBER

Capacity - 6,930 gal.

Retention - 30 minutes at 330,000 gal.

Chlorinator

1 - Fischer and Porter gas chlorinator

Capacity - 50 lb. chlorine/day
Solution injector - 100 lb./day equipped with 1000 lb. scale

Manifold feed allows 2 - 150 lb. chlorine cylinders to be used at one time.

SLUDGE ACTIVATION TANK

Capacity - 83,000 gal.

Sludge detained for a nominal period of six (6) hours

NO. 1 AEROBIC DIGESTER (Primary)

Capacity - 55,250 gal.

Sludge aerated for at least 3 - 5 days

NO. 2 AEROBIC DIGESTER (Secondary)

Capacity - 27,620 gal.

Sludge aerated for not less than 15 days

RECEIVING STREAM

Penetanguishene Harbour - Georgian Bay

APPENDIX CTABLE 1PENETANGUISHENE WATER WORKS1968 WATER PUMPAGES (million gallons)

<u>MONTH</u>	<u>TOTAL</u>	<u>MAXIMUM DAY</u>	<u>MINIMUM DAY</u>	<u>AVERAGE DAY</u>
January	16.27	0.580	0.440	0.525
February	15.74	0.560	0.480	0.562
March	16.72	0.650	0.400	0.540
April	15.59	0.640	0.350	0.520
May	16.62	0.690	0.410	0.537
June	17.97	0.700	0.470	0.600
July	23.97	1.010	0.560	0.773
August	19.36	0.770	0.480	0.625
September	16.25	0.670	0.360	0.541
October	15.36	0.580	0.390	0.495
November	13.37	0.550	0.370	0.456
December	13.99	0.590	0.330	0.450
TOTAL PUMPAGE	—	201,210,000 gallons		
Maximum Day	-	1,010,000 gallons		
Minimum Day	-	350,000 gallons		
Average Day	-	549,754 gallons		
Per Capita Usage	-	109.9 gallons/capita/day		

APPENDIX CTABLE 2PENETANGUISHENE WATER WORKS1969 WATER PUMPAGES (million gallons)

<u>MONTH</u>	<u>TOTAL</u>	<u>MAXIMUM DAY</u>	<u>MINIMUM DAY</u>	<u>AVERAGE DAY</u>
January	16.40	0.600	0.410	0.529
February	14.92	0.570	0.440	0.533
March	15.97	0.570	0.430	0.515
April	15.77	0.620	0.400	0.526
May	19.92	0.760	0.480	0.643
June	17.87	0.850	0.460	0.596
July	18.34	0.780	0.490	0.592
August	20.38	0.800	0.570	0.657
September	16.51	0.650	0.510	0.550
October	15.93	0.580	0.420	0.514
November	16.29	0.650	0.450	0.543
December	16.72	0.590	0.430	0.539
TOTAL PUMPAGE	-	205,020,000 gallons		
Maximum Day	-	850,000 gallons		
Minimum Day	-	400,000 gallons		
Average Day	-	561,698 gallons		

APPENDIX DTABLE 1TOWN OF PENETANGUISHENEW.P.C.P. PERFORMANCE - 1968 TO DATE

SAMPLING DATE	<u>BOD (ppm)</u>		<u>SS (ppm)</u>		<u>MLSS (ppm)</u>	PRIMARY DIGESTER S.S.
	RAW	FINAL	RAW	FINAL	(CONTACT TANK)	
Jan. 4/68	65	4.0	114	6	12,918	17,482
Jan. 18/68	58	6.4	84	10	12,676	15,964
Feb. 1/68	38	2.0	60	2	10,048	17,312
Feb. 8/68	34	3.4	62	5	7,642	15,620
Feb. 15/68	75	4.0	142	9	9,586	14,860
Mar. 7/68	110	6.4	88	5	8,956	18,414
Mar. 14/68	155	5.2	128	7	7,752	18,256
Mar. 28/68	34	3.2	120	2	6,046	23,502
May 9/68	165	10.0	218	6	8,648	19,736
June 20/68	135	4.4	139	1	11,966	16,820
Aug. 22/68	126	9.4	31	4	6,292	16,100
Sept. 12/68	340	0.8	212	6	8,362	16,778
Sept. 19/68	90	14.0	106	3	13,682	
Oct. 15/68	260	16.0	321	13	5,776	23,174
Dec. 17/68	95	1.5	90	10	5,860	55,500
Jan. 14/69	190	11.0	190	10	5,870	17,200
Feb. 11/69	80	7.0	190	10	5,412	15,106
Mar. 18/69	30	3.0	40	10	5,320	16,200
Apr. 15/69	120	2.0	140	10	4,680	21,600
May 13/69	70	6.0	110	20	4,760	22,350
June 17/69	90	5.0	140	10	5,990	18,770
July 14/69	55	6.0	80	5	5,040	10,000
Aug. 19/69	52	11.0	120	5	6,200	11,150
Sept. 10/69	100	5.5	110	10	-----	-----
Sept. 16/69	90	5.0	150	10	7,060	-----
Oct. 14/69	44	5.0	130	5	6,230	17,640
Nov. 18/69	35	4.5	80	15	5,060	19,000
Dec. 16/69	99	20.0	205	20	5,130	13,380
Dec. 18/69	130	29.0	230	40	3,920	-----

SAMPLING DATE	<u>BOD (ppm)</u>		<u>SS (ppm)</u>		<u>MLSS (ppm)</u>	PRIMARY DIGESTER SS
	RAW	FINAL	RAW	FINAL	(CONTACT TANK)	
Jan. 13/70	110	15.0	155	10	5,930	-----
Feb. 17/70	60	11.0	110	25	6,450	23,490
Mar. 17/70	60	4.5	100	20	7,590	27,570
Apr. 14/70	20	4.5	70	10	6,890	-----
May 12/70	75	3.5	140	20	6,425	24,260
June 16/70	40	3.0	55	5	6,170	27,945
July 15/70	32	9.5	170	15	4,660	23,900
Aug. 18/70	80	13.0	120	20	4,760	-----
AVERAGE	93.	7.4	128.	10.2	7,104	
MAXIMUM	340	29.0	321.	40.0	13,682	
MINIMUM	20	0.8	31.	1.0	3,920	

PLANT REMOVAL EFFICIENCIES:

BODS.S.

92%

92%

APPENDIX ETABLE 1

TOWN OF PENETANGUISHENE
MUNICIPAL WATER POLLUTION CONTROL PLANT
(CONTACT STABILIZATION)

R A W S E W A G E P L A N T S T U D Y F E B R U A R Y 2 5 , 2 6 , 2 7 / 6 9

TIME	BOD	TOTAL	SOLIDS	
			SUSP.	DISS.
10:30-12:45 PM	90	750	170	580
1:45-2:45 PM	130	1130	280	850
3:30-6:30 PM	85	670	110	560
7:00-9:30 PM	120	530	100	430
9:30-11:30 PM	50	470	50	420
11:50-3:00 AM	34	420	40	380
3:00 AM Grab	38	380	60	320
7:00-12:30 PM	100	690	60	630
1:00-7:00 PM	95	600	130	470
AVERAGE	82.4	626.7	111.1	448.9
MAXIMUM	130	1130	280	850
MINIMUM	38	380	40	320

APPENDIX ETABLE 2TOWN OF PENETANGUISHENEMUNICIPAL WATER POLLUTION CONTROL PLANT
(CONTACT STABILIZATION)

F I N A L E F F L U E N T P L A N T S T U D Y February 25, 26,
27/69

TIME	BOD	TOTAL	<u>SOLIDS</u>	
			SUSP.	DISS.
10:30-12:45 PM	6.5	430	10	420
1:45-2:45 PM	* 170.0	1080	600	480
3:30-6:30 PM	5.0	550	10	540
7:00-9:30 PM	30.0	590	90	500
9:30-11:30 PM	26.0	520	40	480
11:50-3:00 AM	6.0	490	5	485
3:00 AM Grab	5.0	440	5	435
7:00-12:30 PM	3.0	480	2	478
1:00-7:00 PM	3.5	580	10	520
AVERAGE	10.6	510.0	21.5	542.3
MAXIMUM	26.0	590	90	540
MINIMUM	3.0	430	2	420

PLANT REMOVAL EFFICIENCIES: BOD S.S.

86.5%

80%

* This sample result was disregarded with respect to the performance summary since at the sampling time, sludge was being lost with the final effluent. This problem has been rectified with sludge haulage from the plant.

APPENDIX ETABLE 3TOWN OF PENETANGUISHENEMUNICIPAL WATER POLLUTION CONTROL PLANT
(CONTACT STABILIZATION)G R A B S A M P L E S P L A N T S T U D Y FEBRUARY 27, 1969

SAMPLE	TIME	SOLIDS		
		TOTAL	SUSP.	DISS.
Aeration	9 AM	5830	5340	430 Dried
		2230	1834	396 Ashed
		3600	3506	94 Loss
Re-Aeration	9 AM	8828	8240	588 Dried
		3254	2800	454 Ashed
		5574	5440	134 Loss
Primary Digester	10 AM	16,224	15,546	678 Dried
		4890	4392	498 Ashed
		11,334	11,154	180 Loss
Secondary Digester	9 AM	52,600	----	--- Dried
		25,200	----	--- Ashed
		27,400	----	--- Loss

APPENDIX F
TABLE 1

TOWN OF PENETANGUISHENE

MUNICIPAL WATER POLLUTION CONTROL PLANT
(CONTACT STABILIZATION)

R A W S E W A G E			P L A N T S T U D Y							SEPTEMBER 22, 1970			
TIME	BOD	SOLIDS			NITROGEN AS N				C.O.D.	PHOSPHORUS AS P		pH LAB	AVG. FLOW (USMGD)
		TOTAL	SUSP.	DISS.	FREE AMMONIA	TOTAL K.	NITRITE	NITRATE		TOT.	SOL.		
10-12 PM	80	500	160	340	13.	24.	.02	<.1	320	9.1	6.7	6.9	0.36
12-2 PM	70	540	90	450	12.	20.	.02	<.1	200	8.0	5.9	6.7	0.39
2-4 PM	75	470	80	390	11.	21.	.02	<.1	150	7.7	5.2	7.2	0.34
4-6 PM	65	480	90	390	13.	24.	.02	<.1	400	6.3	4.3	7.2	0.33
6-8 PM	110	450	80	370	12.	18.	.03	<.1	200	5.8	4.5	6.9	0.32
AVERAGE	80	488	100	388	12.2	21.4	.02	<.1	254	7.4	5.2	7.0	0.34
MAXIMUM	110	540	160	450	13.	24.	.03	<.1	320	9.1	6.7	7.2	0.37
MINIMUM	65	450	80	340	11.	18.	.02	<.1	150	5.8	4.3	6.7	0.31

APPENDIX F
TABLE 2

TOWN OF PENETANGUISHENE

MUNICIPAL WATER POLLUTION CONTROL PLANT
(CONTACT STABILIZATION)

<u>F I N A L E F F L U E N T</u>					<u>P L A N T S T U D Y</u>					<u>SEPTEMBER 22, 1970</u>			
<u>TIME</u>	<u>BOD</u>	<u>SOLIDS</u>			<u>NITROGEN AS N</u>				<u>C.O.D.</u>	<u>PHOSPHORUS AS P</u>		<u>pH LAB</u>	<u>AVG. FLOW (USMGD)</u>
		<u>TOT.</u>	<u>SUSP.</u>	<u>DISS.</u>	<u>FREE AMMONIA</u>	<u>TOTAL K.</u>	<u>NITRITE</u>	<u>NITRATE</u>		<u>TOT.</u>	<u>SOL.</u>		
10-12 PM	9.0	330	10	320	11.	15.	.04	.14	40	6.0	5.4	7.4	0.36
12-2 PM	11.0	350	10	340	11.	16.	.02	.2	40	7.2	6.0	7.1	0.39
2-4 PM	10.0	340	5	335	11.	15.	.02	.2	35	6.8	6.7	7.4	0.34
4-6 PM	12.0	350	10	340	11.	15.	.02	.1	35	7.5	7.3	8.7	0.33
6-8 PM	14.0	330	10	320	11.	16.	.02	.1	40	7.5	7.3	7.7	0.32
AVERAGE	11.2	340	9	331	11.	15.4	.024	.15	38.0	7.0	6.5	7.6	0.34
MAXIMUM	14	350	10	340	11.	16.	.04	.2	40	7.5	7.3	7.1	0.37
MINIMUM	9	330	5	320	11.	15.	.02	.1	35	6.0	5.4	8.7	0.31
PLANT REMOVAL EFFICIENCIES:		<u>BOD</u>		<u>SS</u>									
		86.4%		91%									

APPENDIX F
TABLE 3

TOWN OF PENETANGUISHENE

MUNICIPAL WATER POLLUTION CONTROL PLANT
(CONTACT STABILIZATION)

<u>A E R A T I O N</u>			<u>P L A N T S T U D Y</u>						<u>S E P T E M B E R 22, 1970</u>			
<u>T I M E</u>	<u>S O L I D S</u>			<u>N I T R O G E N A S N</u>				<u>C.O.D.</u>	<u>P H O S P H O R U S A S P</u>		<u>pH L A B</u>	<u>F L O W (M G D)</u>
	<u>T O T A L</u>	<u>S U S P.</u>	<u>D I S S.</u>	<u>F R E E A M M O N I A</u>	<u>T O T A L K.</u>	<u>N I T R I T E</u>	<u>N I T R A T E</u>		<u>T O T.</u>	<u>S O L.</u>		
10 AM	4230	3810	420	21.	475.	.01	<.1	5100	170.	38.	6.9	0.33
1 PM	4980	4520	460	16.	325.	.01	<.1	4700	130.	35.	6.8	0.35
4 PM	4500	4080	420	17.	650.	.01	<.1	4200	200.	21.	7.1	0.33
7 PM	4400	3950	450	17.	350.	.04	<.1	4200	130.	22.	7.9	0.32
AVERAGE	4527	4090	437	17.	450.	.02	<.1	4550	158.	29.	7.2	0.34
MAXIMUM	4980	4520	460	21.	475.	.04	<.1	5100	200	38.	7.9	0.35
MINIMUM	4230	3810	420	16.	325.	.01	<.1	4200	130.	21.	6.8	0.32

APPENDIX F

TABLE 4

TOWN OF PENETANGUIHENE

MUNICIPAL WATER POLLUTION CONTROL PLANT
(CONTACT STABILIZATION)

R E - A E R A T I O N

P L A N T S T U D Y

SEPTEMBER 22, 1970

TIME	<u>SOLIDS</u>			<u>NITROGEN AS N</u>				C.O.D.	<u>PHOSPHORUS AS P</u>		pH LAB	FLOW (MGD)
	TOTAL	SUSP.	DISS.	FREE AMMONIA	TOTAL K.	NITRITE	NITRATE		TOT.	SOL.		
10 AM	9980	9450	530	20.	500.	.02	<.1	7500	190.	55.	6.5	0.33
1 PM	8780	8260	520	18.	600.	.01	<.1	8000	200.	67.	6.5	0.35
4 PM	8240	7720	520	23.	650.	.01	<.1	8200	210.	38.	7.2	0.33
7 PM	8270	7780	490	20.	600.	.02	<.1	8300	200.	43.	7.2	0.32
AVERAGE	8818	8303	515	20.	588.	.02	<.1	8000	200.	51.	6.9	0.34
MAXIMUM	9980	9450	530	23.	650.	.02	<.1	8300	210.	67.	7.2	0.35
MINIMUM	8240	7720	490	18.	500.	.01	<.1	7500	190.	43.	6.5	0.32

APPENDIX GTABLE 1PENETANGUISHENE W.P.C.P. FLOWS1968

All flows in US gallons.

<u>MONTH</u>	<u>TOTAL</u>	<u>MAXIMUM DAY</u>	<u>AVERAGE DAY</u>
January	8,847,900	434,000	285,000
February	12,635,200	635,800	438,000
March	16,921,800	698,400	548,000
April	13,409,800	697,900	448,000
May	9,362,500	543,900	302,000
June	6,338,400	264,600	212,000
July	5,791,300	304,400	186,000
August	8,101,200	558,800	263,000
September	11,548,700	654,300	385,000
October	11,868,700	539,600	384,000
November	11,500,300	487,400	385,000
December	Integrator out	485,100	

SUMMARY: (11 month period)

TOTAL	-	116,325,800 gals.
MAXIMUM DAY	-	698,400 gals.
AVERAGE DAY	-	317,830 gals.

APPENDIX GTABLE 2PENETANGUISHENE W.P.C.P. FLOWS1969

All flows in US gallons.

<u>MONTH</u>	<u>TOTAL</u>	<u>MAXIMUM DAY</u>	<u>MINIMUM DAY</u>	<u>AVERAGE DAY</u>
January	14,459,100	661,000	316,900	466,422
February	12,374,200	547,000	403,200	441,936
March	14,417,800	531,200	400,500	465,090
April	14,690,300	533,000	438,000	489,677
May	13,966,400	555,900	353,900	450,529
June	12,068,200	484,800	353,300	402,273
July	11,409,800	574,400		368,058
August	7,423,800	349,920	180,500	239,478
September	8,003,800	418,200	214,700	266,793
October	10,428,300	463,600	219,400	336,397
November	11,093,700	479,200	293,600	369,790
December	12,710,400	481,700	292,400	410,013

SUMMARY:

TOTAL - 1969	- 143,045,808 gals.
MAXIMUM DAY	- 661,000 gals.
MINIMUM DAY	- 180,500 gals.
AVERAGE DAY	- 391,906 gals.

APPENDIX GTABLE 3PENETANGUISHENE W.P.C.P. FLOWS1970

All flows in US gallons.

MONTH	TOTAL	MAXIMUM DAY	MINIMUM DAY	AVERAGE DAY	<u>BY-PASSING</u>	
					Total Hours	Percentage of Month
January	11,987,700	425,900	346,800	386,700	not recorded	
February	11,442,600	437,300	347,800	408,664	270.5	40.2
March	14,694,800	548,600	386,500	474,026	474.5	63.8
April	13,388,300	480,800	206,100	446,276	639.75	88.9
May	10,527,100	457,700	223,600	339,584	204.25	27.5
June	9,665,800	473,300	226,500	322,193	69.75	9.7
July	12,995,900	467,700	290,000	419,223	497.75	66.9
August		449,700	336,300		101.00	13.6

SUMMARY: (January to July, 1970)

TOTAL	84,702,215 gals.
MAXIMUM DAY	548,600 gals.
MINIMUM DAY	206,100 gals.
AVERAGE DAY	399,539 gals.
TOTAL HRS. BYPASSED IN SIX MONTHS	2257.5 hrs.
PERCENTAGE TIME OF SIX MONTHS	38.7 %

APPENDIX GTABLE 4PENETANGUISHENE W.P.C.P.REMOVAL OF SLUDGE FROM SECONDARY DIGESTER

<u>DATE</u>	<u>TOTAL IN INCHES OF TANK</u>	<u>* VOLUME IN US GAL. OF SLUDGE REMOVED</u>
January 8	119.5	22,000
April 27	76.5	14,100
May 19	94.0	17,300
July 28	77.0	14,200
September 11	22.0	4,050
		71,650 US gal.

TOTAL SLUDGE REMOVED FROM SECONDARY DIGESTER
IN SLIGHTLY OVER 9 MONTHS = 71,650 US gal.

* Secondary Digester: 1 ft. depth = 2210 US gal.
1 in. depth = 184 US gal.

APPENDIX HWATER CONSUMPTION AND SEWAGE FLOW CALCULATIONS FOR 1969Note:

See Section

"WATER CONSUMPTION"

for major water consumers and number of family units, sewerred,
and unsewerred from which information is used below:

Total 1969 Water Pumpage 205.0 MIG

WATER CONSUMPTION BREAKDOWN

Family Units on Water - 1455
Family Units on Sewer - 941
Family Units on Water
and Unsewerred 514

Avg. water consumption per family unit

$$= \frac{\text{Pure Residential Demand}}{\text{Family Units on Water}} = \frac{139.5}{1455}$$

$$= 0.096 \text{ MIG/unit/year}$$

$$\text{Residential Unsewerred Water Consumption} = 514 \times 0.096$$

$$= 49.3 \text{ MIG}$$

$$\text{Mental Health Center Water Consumption} = 39.9 \text{ MIG}$$

(unsewerred)

$$\text{Total Unsewerred Water Consumption} = 89.2 \text{ MIG}$$

Total Sewered Water Consumption

$$= \text{Total 1969 Pumpage} - \text{Total Unsewered Water Consumption}$$

$$= 205.0 - 89.2$$

$$= 115.8 \text{ MIG}$$

$$\text{Total 1969 Treated Sewage Flow} = 143.1 \text{ M US G}$$

$$= 119.2 \text{ MIG}$$

Average Daily Flow Sewered Water Consumption

$$= \frac{115.8}{365} = 0.317 \text{ MIG}$$

Average Daily Flow Treated Sewage

$$= .327 \text{ MIG}$$

SUMMARY :

	<u>Average Day (MIG)</u>	<u>Total Year (MIG)</u>
Treated Sewage:	0.327	119.2
Sewered Water:	<u>0.317</u>	<u>115.8</u>
Difference:	0.010	3.4

APPENDIX ITABLE 1PRECIPITATION SUMMARIESMIDLAND STATION1969

MONTH	TOTAL PRECIPITATION	NO. OF DAYS WITH .01 OR MORE	HEAVIEST FALL IN MONTH	DATE	DIFFERENCE FROM NORMAL
JANUARY	3.58	21	0.52	6	- 0.33
FEBRUARY	1.68	8	0.80	2	- 1.34
MARCH	1.15	7	0.55	20	- 1.70
APRIL	3.18	11	0.76	17	0.27
MAY	4.49	10	1.48	18	1.72
JUNE	5.07	13	1.37	26	2.49
JULY	3.32	12	0.70	10	0.16
AUGUST	1.03	4	0.37	16	- 2.07
SEPTEMBER	3.33	13	0.75	5	- 0.60
OCTOBER	4.19	16	0.87	19	0.82
NOVEMBER	4.64	14	0.78	1	1.10
DECEMBER	2.85	11	0.70	10	- 1.47

TOTAL PRECIPITATION 1969 - 38.51 inches

APPENDIX ITABLE 2PRECIPITATION SUMMARIESMIDLAND STATION1970

MONTH	TOTAL PRECIP.	NO. OF DAYS WITH .01 OR MORE	HEAVIEST FALL IN MONTH	DATE	DIFFERENCE FROM NORMAL
JANUARY	5.62	15	1.30	5	1.71
FEBRUARY	1.53	12	0.40	10	-1.49
MARCH	2.80	11	0.72	4	-0.05
APRIL	2.50	7	0.70	2	-0.41
MAY	2.31	13	0.69	10	-0.46

APPENDIX I

TABLE 3

DEPARTMENT OF TRANSPORT METEOROLOGICAL OBSERVATIONS

WITH DAILY BYPASSING PERIODS - 1970

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	TOTAL
<u>FEBURARY</u>																															
HOURS BYPASSING	11	18	16	16	15	13	12	13	11	15	14	0	0	0	0	10	12	12	6	15	16	12	15	12	3.5	0	0	9			270.5
PRECIPITATION (IN.)	T			.1	.1					.4	.1	.02	T	T	T			.1	.1	.25	.15	T		.01		.1	.1				1.53
TEMPERATURE: MAX.	44	39	12	28	30	40	43	36	34	34	20	14	8	20	20	25	38	45	16	21	38	42	34	41	10	25	34	25			
MIN.	32	33	0	-12	7	7	23	21	12	28	15	7	-5	-7	0	12	13	23	7	11	15	24	11	25	0	-2	12	14			
<u>APRIL</u>																															
HOURS BYPASSING	13		18.3	19.8		18.5		23.5	23		24	22.8	23	23	22	22.8	24	24	23.5	24	23	23	23	23.5	22.5	22.5	22.5	19.8	16.5	12.5	639.75
		13.5	23.3				22.5	23.3																							
PRECIPITATION (IN.)	.4	.7						T	T						T				.37	.36	.28	.27		.12					T		2.50
TEMPERATURE: MAX.	41	33	41	43	40	45	51	57	51	31	33	41	51	52	49	58	63	42	51	59	48	56	68	54	65	79	77	83	80	80	
MIN.	28	29	26	28	22	29	31	31	37	23	11	20	22	28	29	27	41	34	25	36	38	38	43	46	38	44	54	50	47	60	45.

APPENDIX ITABLE 41969 RUNOFF CALCULATIONS

1 acre - ft. = 325,851 US gal.

= 271,454 Imp. gal.

1 acre - inch = 22,621 Imp. gal.

Total Precipitation for 1969 = 38.51 inches

Total area with sewers reaching S.T.P. = 625 acres

. . Total Precipitation Volume

= 625 acres x $\frac{22,621 \text{ I. gal.}}{\text{acre - in.}}$ x 38.51 in.

= 544,459,375 I. gal.

Runoff Coefficients:	Downtown areas	0.70 to 0.95
	Neighborhood areas	0.50 to 0.70
	Single-family areas	0.30 to 0.50
	Multi-units detaches	0.40 to 0.60
	Residential (suburban)	0.25 to 0.40
	Apartment dwelling areas	0.50 to 0.70

Above coefficients from 1967 WPCF Manual of Practice No. 9
"Design and Construction of Sanitary and Storm Sewers"

Assumed runoff coefficient 0.40

ESTIMATED VOLUME OF RUNOFF TO PLANT

= 0.40 x 544,459,375

= 217,783,750 I. gal.

APPENDIX J

TABLE I

WATER POLLUTION SURVEY FOLLOW-UP - 1970

SAMPLING POINT	DATE	5-DAY BOD (PPM)	SOLIDS (PPM)			TURBIDITY	NITROGEN AS N (PPM)				PHOSPHORUS AS P (PPM)		ANIONIC DETERGENTS AS ABS (PPM)	BACTERIOLOGICAL RESULTS		
			TOTAL	SUSP.	DISS.		FREE AMMONIA	TOTAL KJELDAHL	NITRITE	NITRATE	TOTAL	SOLUBLE		COLIFORM BACTERIA	FECAL COLIFORMS	STREPTOCOCCUS
PH-6-W: 36" CONCRETE SEWER AT FOOT OF SCOTT ST.	JUNE 28/67	50.0	392	20	302	8								22,000,000		
	SEPT. 23/70	14.0	400	10	390		1.0	4.0	1.55	3.0	1.0	0.4	0.6	540,000	107,000	1,500
	OCT. 21/70	7.0	540	60	480		0.95	3.0	0.14	3.4	2.0	0.55	0.7	132,000	114,000	4,300
PH-7-W: CONCRETE STORM SEWER JUST SOUTH OF WPCP	JUNE 28/67	2.0	440	31	409									10,100		
	SEPT. 23/70													4,700	900	4
	OCT. 21/70	11.0	350	50	300		0.45	3.0	0.040	0.67	0.60	0.20	0.2	780,000	750,000	8,000
PH-18-W: FOX STREET STORM SEWER OUTFALL	JUNE 27/67	0.8	218	16	202	4								690,000		
	SEPT. 23/70	1.2	210	5	205		<.1	0.50	0.03	0.8	N/A	<.1	0.1	11,000	3,900	180
	OCT. 21/70	0.8	250	10	240		0.04	0.53	0.006	0.39	0.065	0.024	0.1	59,000	1,000	100
FOX STREET OUTFALL AT FOOT OF DON STREET	SEPT. 23/70	1.6	210	15	195		<.1	0.35	0.02	0.6	N/A	<.1		4,200	200	24
W-1: 36" CONCRETE STORM SEWER NEAR HYDRO OFFICE	OCT. 21/70		SAMPLE WAS ANALYSED BY GAS CHROMATOGRAPHY FOR ETHYLENE GLYCOL, WHICH WAS DETECTED AT A LEVEL OF 6 PPM											120,000	100	
C-0.5: COPELAND CREEK OPPOSITE LANDFILL SITE	JUNE 28/67	1.0	184	10	174									7,500		
	SEPT. 23/70													25,000	10,500	428
	OCT. 21/70	0.8	200	10	190		0.10	0.58	0.007	0.39	0.04	0.02		9,000	5,100	
C-0.5-W: STORM SEWER OUTFALL TO COPELAND CREEK	JUNE 28/70	6.4	268	6	262									360,000		
	SEPT. 23/70	2.5	220	15	205		<.1	0.16	0.02	0.6	0.029	<.1	0.0	1,100	24	
	OCT. 21/70	3.5	280	30	250		1.3	2.5	0.04	0.20	0.60	0.27		340,000	20,000	
COPELAND CREEK AT CHAMPLAIN ROAD	OCT. 21/70	0.8	220	10	210		<0.01	0.38	0.003	0.20	0.04	0.004		270	80	

APPENDIX K

TABLE 1

TOWN OF PENETANGUISHENE

PROJECTED WORKS 1970 to 1974

<u>PROJECTS</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>
West End Sanitary Sewers Phase 1 & 2	52,000				
Waterworks, Replacements of Services and New Installations	12,000				
West End Sanitary Sewers Phase 3 & 4		45,000			
Storm Sewer Edward Street (1)		40,000			
West End Sanitary Sewers Phase 5 & 6			55,000		
Yeo Street Area Sanitary Sewer Phase 1			20,000		
Yeo Street Area Sanitary Sewer Phase 2				33,000	
Sewage Treatment Plant Enlargement				50,000	
Yeo Street Area Sanitary Sewer Phase 3 & 4					52,000
Roads (1)					13,000

The bacteriological report is, basically, a report on the presence or absence of coliform bacteria in the sample submitted.

The direct search for the presence of specific pathogenic bacteria or viruses in water is impracticable for routine control purposes. Bacteriologists have therefore evolved simple and rapid tests for the detection of normal intestinal organisms, ie. coliform bacteria, faecal streptococci and *Clostridium perfringens*. The test provides an estimate of the number of coliform organisms present in 100 millilitres, which is equivalent to about 4 fluid ounces, of the water sampled.

The organisms most commonly used as indicators of faecal pollution are the coliform group as a whole, and particularly *Escherichia coli*, which is undoubtedly of faecal origin, and is referred to as faecal coliforms in the bacteriological report.

Examination for faecal streptococci and for *Clostridium* may sometimes be of value in confirming the faecal nature of pollution in doubtful cases. Faecal streptococci regularly occur in faeces in varying numbers, which are usually considerably smaller than those of *E. coli*.

When organisms of the coliform group but not *E. coli* are found in a water sample, the finding of faecal streptococci affords important confirmatory evidence of the faecal nature of the pollution. *Clostridium* is also regularly found in faeces though generally in much smaller numbers than *E. coli*. The spores are capable of surviving in water for a longer time than organisms of the coliform group and usually resist chlorination at doses normally used in water works practice. The presence of *clostridium* in a natural water suggest that faecal contamination has occurred, and its presence in the absence of organisms of the coliform group suggests that the contamination occurred at some remote date.

Colony counts provide an estimate of general bacterial purity, which is of particular value when water is used industrially for the preparation of food and drink. They may also give forewarning of pollution.

Faecal coliforms usually outnumber all the other coliform types in the human and animal intestines by a ratio of more than 500 to 1. Outside the body, faecal coliforms die off more quickly than the other coliform types. Therefore, if most of the coliforms are faecal coliforms, and their number is high, the pollution is probably nearby,

recent, and relatively more dangerous. Smaller numbers but a high proportion of faecal coliforms may indicate nearby pollution with counts reduced by dilution.

APPENDIX MANALYTICAL TERMSANIONIC DETERGENTS (as Alkyl Benzene Sulphonate - A.B.S.)

The presence of detergents in natural waters usually indicates contamination by domestic wastes. While A.B.S. is not toxic to most biota at low levels, it can be objectionable because of the foaming it may cause.

Samples which do not produce any foam when shaken vigorously contain less than 0.5 mgms per l. This is the objective for natural waters, and it is not necessary to request A.B.S. analysis on samples if shaking does not induce a perceptible foam.

The results include both A.B.S. and the recently introduced "linear" forms L.A.S., although pure A.B.S. is used to calibrate the test and the results are expressed in these terms.

BIOCHEMICAL OXYGEN DEMAND (BOD)

The most frequent damage caused by the discharge of wastes to natural waters, next only to bacterial contamination, is the reduction of dissolved oxygen concentrations to levels which cannot support normal aquatic life. The resulting fish kills are accompanied by deterioration of the water quality for all uses. The dissolved oxygen is depleted through oxidation

of the organic content of the wastes by bacteria (occasionally by direct chemical oxidation). The BOD test is a measure of the amount of dissolved oxygen required for the process of stabilization of the decomposable organic matter by aerobic bacterial action in a specific length of time (five days) under standard conditions (20°C in the dark).

CHEMICAL OXYGEN DEMAND (COD)

The chemical oxygen demand determination measures the weight of oxygen which will react with a given waste material under vigorous chemical oxidation conditions. The test gives a rapid estimate of the strength of a waste and is particularly useful for industrial wastes on which the BOD test is not applicable as it may give false low results.

Most organic compounds are oxidized by the test, benzene, toluene and pyridine being the common exceptions. The silver catalyst aids in oxidizing straight chain compounds. The results do not necessarily relate directly to the BOD value or to the oxygen consumption in the receiving water. They do represent a maximum carbonaceous oxygen demand which might ultimately be exerted in the water through time. Variations in COD from time to time at a given sampling location, or for a given effluent, may be more important than the absolute value of individual measurements. If comparative analysis show that a stable ratio exists between COD and BOD in a particular case,

the COD results can then be used to predict the approximate BOD values.

NITROGEN AS N

Free Ammonia and Total Kjeldahl Nitrogen

Free ammonia is undesirable in surface water because it is toxic to fish; exerts a high oxygen demand when converted to nitrite and nitrate by bacteria; interferes with chlorination procedures at water treatment plants and is a source of nitrogen for plants which can help promote excessive growth. It is rarely found in concentrations high enough to be harmful to humans.

The total kjeldahl nitrogen measures the sum of the free ammonia and the "organic nitrogen" (amines, proteins, etc.). "Organic nitrogen" can thus be obtained as the difference between the free ammonia and the total kjeldahl nitrogen results. The total kjeldahl nitrogen value does not include nitrite or nitrate which may be present in the sample.

Ammonia is often an indication of contamination by raw or partly treated sewage; however, because of its rather short life in surface waters it may not reveal completely the extent of the pollution. Results must be interpreted with full allowance for the perishability of this form of nitrogen, both in situ and in the sample

following collection.

Ammonia is often converted to organic forms by bacteria, particularly if there is a good supply of organic carbon, so the total kjeldahl nitrogen value can be a better indication of the effects of an ammonia input than the ammonia concentration alone.

There may be oxidation of ammonia to nitrite and nitrate, so that measurement of these two compounds, in addition to the total kjeldahl nitrogen, may be required to trace the effect of a waste input.

pH

pH is a measure of the hydrogen ion concentration in water. Specifically, it is the negative logarithm of the free hydrogen ion concentration expressed in moles per liter. Thus, each change of one unit in pH corresponds to a 10-fold hydrogen ion concentration change. Neutral solutions have a hydrogen ion concentration of 10^{-7} moles per liter; therefore, the pH is 7.

pH does not measure the total amount of acidity (or alkalinity) in the water, since some may be in a combined form and therefore will not be included in the pH measurement of free hydrogen ions. The combined forms can still be released to react with bases. The commonest example in water is the bicarbonate ion, which can react with acids to form carbonic acid,

or with bases to form carbonates and water.

PHOSPHORUS AS P

Soluble Phosphorus

The soluble phosphorus content of a sample is that fraction which will pass through a filter and will react chemically with the reagents used to determine the concentration of orthophosphate yielding a positive test response.

It is generally accepted that some organic and even particulate forms can react similarly to orthophosphate and, for this reason, the results are often referred to as "soluble reactive phosphorus", which removes the implication that the test measures only orthophosphate.

The meaning of this parameter has been left in some doubt by a number of researchers (Rigler and Fitzgerald). They have shown that:

- a) particulate matter which can pass through pore sizes of 0.22 microns can alter the result.
(This laboratory has been unable to confirm this finding for Great Lakes samples);
- b) the soluble phosphorus concentration can change rapidly with time after collection, unless adequately preserved.

Anyone making conclusions based on soluble phosphorus results should be acquainted with the various interpretations made of such results.

Total Phosphorus

Phosphorus is an essential plant nutrient and is believed to play an important role in the deterioration of the quality of natural waterways by promoting an overabundance of plants. It occurs in natural and waste waters in several different chemical combinations, such as orthophosphate (PO_4), organic phosphates and polyphosphates. Since most or all of these forms can eventually be used by plants and animals, determination of the total phosphorus concentration is more relevant than measurement of individual phosphorus compounds.

SOLIDS

Measurement of total, suspended and dissolved solids concentrations are traditional tests. An estimate of the organic fraction of the solids and of the organic content of sediments is obtained by heating the samples to 600°C in a furnace to burn off the combustible matter.

The suspended solids concentration relates to turbidity, and the dissolved solids concentration affects the specific conductivity, although there are no common factors for converting one to the other in all cases. A numerical

relationship can often be obtained for a given area or type of water. Ontario rivers, free of industrial wastes, have a dissolved solids concentration of 0.65 ± 0.10 times the specific conductivity. The dissolved solids by weight concentration test has been largely superseded by the more accurate conductivity measurement.

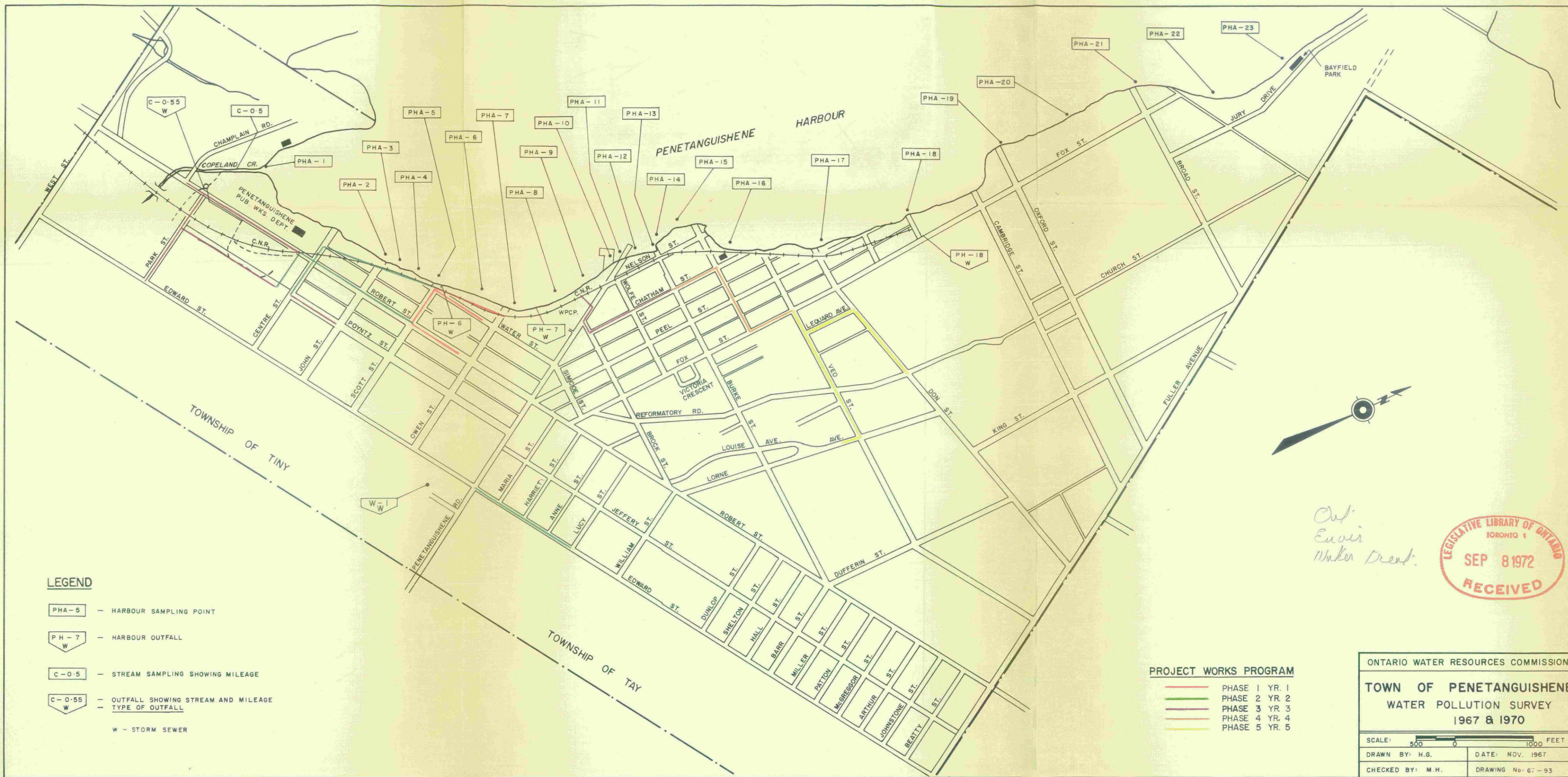
TURBIDITY

Clarity is one of the main criteria which the public uses in judging water quality, either for drinking or for recreational use. This makes the measurement of turbidity a much more valuable gauge of water quality than the suspended solids test, which measures only the weight of particles present in suspension and has little direct bearing on the appearance of the water. For instance, the presence of a few grains of sand or other coarse sediment, which produces a substantial suspended solids value, has little or no effect on the turbidity. It is recommended that field staff should make greater use of turbidity measurements in place of suspended solids tests.

OWRC Drinking Water Objectives have recently been decreased from 5 J.T.U. to 1 J.T.U., in recognition of the increased efficiency of water treatment now possible. (Note the limits of precision above).

Turbidity in large volumes of water is noticeable

at levels above 5 J.T.U., and many members of the public complain that the water is 'dirty' or 'cloudy' in such uses, particularly if they desire to swim or fish. Turbidity is certainly the main criterion which citizens employ in assessing the quality of water, and surveys of water quality should always include turbidity measurements.

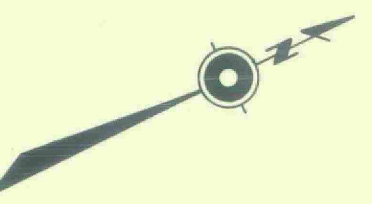


LEGEND

- PHA-5 - HARBOUR SAMPLING POINT
- PH-7 W - HARBOUR OUTFALL
- C-0.5 - STREAM SAMPLING SHOWING MILEAGE
- C-0.55 W - OUTFALL SHOWING STREAM AND MILEAGE
- W - STORM SEWER

PROJECT WORKS PROGRAM

- PHASE 1 YR. 1
- PHASE 2 YR. 2
- PHASE 3 YR. 3
- PHASE 4 YR. 4
- PHASE 5 YR. 5



Out
Envis
Water Treat.



ONTARIO WATER RESOURCES COMMISSION

TOWN OF PENETANGUISHENE
WATER POLLUTION SURVEY
1967 & 1970

SCALE: 500 0 1000 FEET

DRAWN BY: H.G. DATE: NOV. 1967

CHECKED BY: M.H. DRAWING No. 67-93



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